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DISCLOSURE OF THE INVENTION

To achieve the objective, an optical control device in accordance with the present invention includes:

a first substrate with at least one light output layer;

a second substrate with a light transmitting function, positioned opposite to the first substrate; and

a liquid crystal sandwiched between the first and second substrates,

one of the first and second substrates having scan electrodes for applying multiple scan signals, one of the first and second substrates having signal electrodes for applying multiple signal voltages,

wherein:

the light output layer is arranged in stripes and extends in the same direction as the scan electrodes for applying scan signals;

the first substrate has thereon a layer with a light polarizing function; and

the first substrate, the light output layer, the layer with a light polarizing function, the liquid crystal, and the second substrate are arranged in this order.

Generally, a display is produced in accordance with a scan signal, and the scan timings vary from one scan

electrode to another for applying scan signals. In contrast, according to the arrangement above in accordance with the present invention, the light output layer is arranged in stripes and extends in the same direction as the scan electrodes for applying scan signals. Therefore, the optical control device in accordance with the present invention can scan the light output layer for every scan timing, that is, the device can vary the light emitting timing for each light output layer corresponding to a scan electrode to for applying scan signals, thereby achieving an impulse-type display. Further, the integration of the light output layer allows for a reduced thickness.

Further, through emission of different wavelengths, for example, R, G, and B light, for each light output layer arranged in stripes, a color display can be produced with no color filters. Hence, light transmission efficiency does not decrease due to use of color filters, and power consumption is reduced. In addition, the provision of a layer with a light polarizing function on the first substrate restrains problems that possibly occur due to a heating process when, for example, active elements are formed on the second substrate.

As mentioned above, an optical control device in accordance with the present invention allows for

reductions in thickness, weight, and power consumption. Further, the impulse-type display allows for less blurred edges and persistent images when producing animation, thereby improving image quality.

Another optical control device in accordance with the present invention includes:

a first substrate with multiple light output layers;

a second substrate with a light transmitting function, positioned opposite to the first substrate; and

a liquid crystal sandwiched between the first and second substrates,

one of the first and second substrates having multiple active elements, one of the first and second substrates having gate electrodes for applying multiple scan signals, one of the first and second substrates having source electrodes for applying multiple signal voltages,

wherein:

each light output layer is arranged in stripes and extends in the same direction as the gate electrodes;

each light output layer shines simultaneously with adjacent light output layers, but with a different wavelength from those of the adjacent light output layers; and

the light output layers shine when a specified time

has elapsed after a set of scan signals are transmitted to the gate electrodes and extinguish before a succeeding set of scan signals are transmitted.

According to the arrangement above, each light output layer is arranged in stripes and extends in the same direction as the gate electrodes for applying scan signals. Therefore, the optical control device in accordance with the present invention can scan the light output layers for every scan timing. That is, the device can set a light emitting timing for each light output layer corresponding to a gate electrode for applying scan signals so that the light output layers shine when a specified time has elapsed after a set of scan signals are transmitted to the gate electrodes and extinguish before a succeeding set of scan signals are transmitted, thereby achieving an impulse-type display using an active drive optical control device. Further, the integration of the light output layers allows for a reduced overall thickness.

Further, through emission of different wavelengths, for example, R, G, and B light, for each light output

without blurred edges and persistent images with the properties of the impulse-type display well maintained, while keeping high display luminance.

The foregoing method of driving an optical control device may be adapted so that: the light output layers shine when a specified time has elapsed after a set of scan signals are transmitted to scan electrodes and extinguishes before a succeeding set of scan signals are transmitted; the light output layers shine with a different wavelength from those of adjacent light output layers; and more than one adjacent light output layers that shine with mutually different wavelengths are caused to shine simultaneously.

According to the method, the light output layers can be scanned correspondingly to applied scan signals for each scan electrode, that is, the light output layers can shine in accordance with scan timings, thereby producing an impulse-type display and allows for reductions in the number of ICs required for use in control.

Another method of driving an optical control device in accordance with the present invention is preferably such that more than one light output layers that shine with mutually different wavelengths are caused to shine simultaneously. This allows for reductions in the number of ICs required for use in control.

Another method of driving an optical control device in accordance with the present invention is preferably such that: the light output layer shines with a different wavelength from those of adjacent light output layers; and each light output layer is either red, green, or blue

function, positioned opposite to the first substrate; and

a liquid crystal sandwiched between the first and second substrates,

one of the first and second substrates having scan electrodes for applying multiple scan signals, one of the first and second substrates having signal electrodes for applying multiple signal voltages,

wherein:

the light output layer is arranged in stripes and extends in the same direction as the scan electrodes for applying scan signals;

the first substrate has thereon a layer with a light polarizing function; and

the first substrate, the light output layer, the layer with a light polarizing function, the liquid crystal, and the second substrate are arranged in this order.

Generally, a display is produced in accordance with a scan signal, and the scan timings vary from one scan electrode to another for applying scan signals. In contrast, according to the arrangement above in accordance with the present invention, the light output layer is arranged in stripes and extends in the same direction as the scan electrodes for applying scan signals. Therefore, the optical control device in

accordance with the present invention can scan the light output layer for every scan timing, that is, the device can vary the light emitting timing for each light output layer corresponding to a scan electrode for applying scan signals, thereby achieving an impulse-type display.

In addition, the integration of the light output layer allows for a reduced overall thickness.

Further, through emission of different wavelengths, for example, R, G, and B light, for each light output layer arranged in stripes, a color display can be produced with no color filters. Hence, light transmission efficiency does not decrease due to use of color filters, and power consumption is reduced.

As mentioned above, an optical control device in accordance with the present invention allows for reductions in thickness, weight, and power consumption. Further, the impulse-type display allows for less blurred edges and persistent images when producing animation, thereby improving image quality.

Another optical control device in accordance with the present invention includes:

a first substrate with multiple light output layers;

a second substrate with a light transmitting function, positioned opposite to the first substrate; and

a liquid crystal sandwiched between the first and

second substrates,

one of the first and second substrates having multiple active elements, one of the first and second substrates having gate electrodes for applying multiple scan signals, one of the first and second substrates having source electrodes for applying multiple signal voltages,

wherein:

each light output layer is arranged in stripes and extends in the same direction as the gate electrodes;

each light output layer shines simultaneously with adjacent light output layers, but with a different wavelength from those of the adjacent light output layers; and

the light output layers shine when a specified time has elapsed after a set of scan signals are transmitted to the gate electrodes and extinguish before a succeeding set of scan signals are transmitted.

With the arrangement, each light output layers is arranged in stripes and extends in the same direction as the gate electrodes for applying scan signals. Therefore, the optical control device can scan the light output layers for every scan timing, that is, the device can vary the light emitting timing for each light output layer corresponding to a gate electrode for applying scan

signals, thereby achieving an impulse-type display.

In addition, the integration of the light output layer allows for a reduced overall thickness.

Further, through emission of different wavelengths, for example, R, G, and B light, for each light output layer arranged in stripes, a color display can be produced with no color filters. Hence, light transmission efficiency does not decrease due to use of color filters, and power consumption is reduced.

As mentioned above, an optical control device in accordance with the present invention allows for reductions in thickness, weight, and power consumption. Further, the impulse-type display allows for less blurred

duration of 5% to 70% of each display frame time.

Placing such limits on the duration of light emission by the light output layer enables high quality animation to be produced without blurred edges and persistent images with the properties of the impulse-type display well maintained, while keeping high display luminance.

Further, preferably, the light output layer emits light for a duration of 15% to 40% of each display frame time.

Placing further limits on the duration of light emission by the light output layer surely enables high quality animation to be produced without blurred edges and persistent images with the properties of the impulse-type display well maintained, while keeping high display luminance.

The foregoing method of driving an optical control device may be adapted so that: the light output layer shines when a specified time has elapsed after a set of scan signals are transmitted to scan electrodes and extinguishes before a succeeding set of scan signals are transmitted; the light output layer shines with a different wavelength from those of adjacent light output layers; and more than one adjacent light output layers that shine with mutually different wavelengths are caused

to shine simultaneously.

According to the method, the light output layer can be scanned correspondingly to applied scan signals for each scan electrode, that is, the light output layer can shine in accordance with scan timings, thereby producing an impulse-type display and allows for reductions in the number of ICs required for use in control.

Another method of driving an optical control device in accordance with the present invention is preferably such that: the light output layer shines with a different wavelength from those of adjacent light output layers; and each light output layer is either red, green, or blue so that red, blue, and green repeat periodically.

The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications as would be obvious to one skilled in the art intended to be included within the scope of the following claims.

INDUSTRIAL APPLICABILITY

As mentioned above, according to the optical control

Claims:

1. (Amended) An optical control device, comprising:

a first substrate with at least one light output layer;

a second substrate with a light transmitting function, positioned opposite to the first substrate; and

a liquid crystal sandwiched between the first and second substrates,

one of the first and second substrates having scan electrodes for applying multiple scan signals, one of the first and second substrates having signal electrodes for applying multiple signal voltages,

wherein:

the light output layer is arranged in stripes and extends in the same direction as the scan electrodes;

the first substrate has thereon a layer with a light polarizing function; and

the first substrate, the light output layer, the layer with a light polarizing function, the liquid crystal, and the second substrate are arranged in this order.

2. (Amended) An optical control device, comprising:

a first substrate with multiple light output layers;

a second substrate with a light transmitting function, positioned opposite to the first substrate; and

a liquid crystal sandwiched between the first and second substrates,

one of the first and second substrates having multiple active elements, one of the first and second substrates having gate electrodes for applying multiple scan signals, one of the first and second substrates having source electrodes for applying multiple signal voltages,

wherein:

each light output layer is arranged in stripes and extends in the same direction as the gate electrodes;

each light output layer shines simultaneously with adjacent light output layers, but with a different wavelength from those of the adjacent light output layers; and

the light output layers shine when a specified time has elapsed after a set of scan signals are transmitted to the gate electrodes and extinguish before a succeeding set of scan signals are transmitted.

3. The optical control device as defined in claim 2, wherein

the active elements are provided on the second

substrate.

4. The optical control device as defined in either one of claims 2 and 3, wherein

the first substrate has a layer with a light polarizing function.

5. The optical control device as defined in any one of claims 1 through 3, wherein:

the light output layer provided on the first substrate is formed by a light emitting layer composed of at least one of an organic EL light emitter, an inorganic

the light output layer shines for a duration of 15% to 40% of each display frame time.

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14. (Amended) A method of driving an optical control device as defined in claim 1, wherein:

the light output layer shines when a specified time has elapsed after a set of scan signals are transmitted to scan electrodes and extinguishes before a succeeding set of scan signals are transmitted;

the light output layer shines with a different wavelength from those of adjacent light output layers; and

more than one adjacent light output layers that shine with mutually different wavelengths are caused to shine simultaneously.

15. The method as defined in claim 14, wherein

each light output layer is either red, green, or blue so that red, blue, and green repeat periodically.

16. (New) The optical control device as defined in claim 2, wherein

the first substrate, the light output layer, the

liquid crystal, and the second substrate are arranged in this order.

17. (New) The optical control device as defined in claim 2, wherein

the light output layer is adjusted in terms of luminance for each gate electrode.

18. (New) The optical control device as defined in claim 17, wherein

the light output layer is adjusted in terms of luminance in accordance with a maximum luminance which is based on the signal voltages applied to the source electrodes.